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A Note to the History of Time

Ricardo Nirenberg

In our *Uncountable: A Philosophical History of Number and Humanity from Antiquity to the Present* (forthcoming in 2021 from University of Chicago Press), my son and co-author David Nirenberg and I discuss Albert Einstein's famous 1922 debate with the philosopher Henri Bergson on the subject of time, a debate that ended with Einstein's declaration: "There is therefore no such thing as a time of philosophers; there is only a psychological time that differs from the physicist's."[1]

Here, as a prelude to my next project, I will take up a later pronouncement by Einstein on the subject, in his popular exposition of his relativity theories, *Über die spezielle und die allgemeine Relativitätstheorie, gemeinverständlich*. The book was first published in 1917, and went through fourteen editions in Germany. The English translation by R.W. Lawson,*Relativity, the Special and the General Theory: A Popular Exposition*, was published in London (Methuen) in 1920; it also achieved many editions. The one that interests me here is the last, of 1954 (also Methuen), containing a previously unpublished appendix, "Relativity and the Problem of Space" (p. 135-157). There, on p. 139, Einstein returns to his final declaration of 1922:

"But what about the psychological origin of the concept of time? This concept is undoubtedly associated with the fact of 'calling to mind,' as well as with the differentiation between sense experiences and the recollections of these. Of itself it is doubtful whether the differentiation between sense experience and recollection (or a mere mental image) is something psychologically directly given to us. Everyone has experienced that he has been in doubt whether he has actually experienced something with his senses or has simply dreamed about it. Probably the ability to discriminate between these alternatives first comes about as the

[1] For the text of that debate, see http://www.sofrphilo.fr/activites-scientifiques-de-la-sfp/conferences/grandes-conferences-en-telechargement/; for its history, see Jimena Canales, The Physicist and the Philosopher, Princeton University Press, 2016.

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result of an activity of mind creating order.

An experience is associated with a 'recollection,' and it is considered as being 'earlier' in comparison with 'present experiences.' This is a conceptual ordering principle for recollected experiences, and the possibility of its accomplishment gives rise to the subjective concept of time, i.e., that concept of time which refers to the arrangement of the experiences of the individual."

The focus of this brief note is the preceding quotation. Einstein takes certain early experiences to be the elements at the origin of our "concept" of time: those experiences are either sensations or recollections of such. An orthodox empiricist view, almost verbatim the same as the one found in Hume's *Treatise*, Book I, Part II, Section 3, it is perfectly adequate from a physicist's perspective and for a physicist's purposes, but hard or impossible to maintain for anyone with any experience with babies or newly born animals. For a baby, who knows nothing about the Einsteinian "calling to mind," must have the experience of periods of screaming asking for mom, comfort and food, unless its needs are always satisfied as soon as, or even before, the baby starts expressing them, which is extremely unlikely. The feeling during those periods of screaming is one of increasing tension, until exhaustion sets in. Whatever representations there may be, the things present and captured by the senses—doorframe, crib clothes, the tic-toc of a clock—serve only to exacerbate the absence of Mom, the presence of unwanted things being an outrage, a mockery of the baby's painful longing.

This remark brings the psychological origin of the *feeling* of time more to the side of the bodily needs and the will, rather than to the side of representation as is the case with Einstein and his "concept of time." In this, Einstein (like Hume and Kant) is typically an intellectualist, a Cartesian. The contrast in outlooks, bodily versus Cartesian, has been the object of previous philosophical studies[2]. That the feeling of tension has an intimate relation with the feeling of time is not only the purview of the philosopher; the linguist, too, is aware of it: in Middle English, "tense" and "time" were synonymous, an equivalence that survived in grammatical usage, as in "past tense of a verb"; a good deal further back, the Latin words "tensio" or "tendere" (to stretch, stretch out, distend, extend), share a common Proto-Indo-European root with the word "tempus" (time). The French word "durée", which Bergson uses for human time to distinguish it from the time of the clocks, comes from Latin "durus" (hard), as do the English words "duration" and "endure." The connection between tension and hardness is physiological rather than intellectual, as is the connection between tension and time.

What is clear to the linguist is also clear to the poet. *El gaucho Martín Fierro*, the epic in rhymed octosyllables about an outlaw gaucho of the Argentine pampas, composed by José

[2]Notably, Francisco J. Varela, Eleanor Rosch, Evan Thompson, *Embodied Mind: Cognitive Science and Human Experience*, MIT Press, 1991.

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Hernández in the 1870s, contains near the end a poetic debate or *payada* between Fierro and a gaucho of African ancestry, simply called Moreno (swarthy). Those payadas may have been a distant, rural offshoot of the old poetic debate between two Provençal troubadours, which was called *tensón*, that is, tension; whether that literary filiation is right or wrong, the case is that Moreno challenges Fierro with the classical question, What is time? And Fierro responds (I dare translate lines 6665-8):

> Moreno, I'll try to say
>
> So far as I can infer:
>
> Time is only the delay
>
> Of what is about to occur.
>
> *Moreno, voy a decir*
>
> *Sigún mi saber alcanza:*
>
> *El tiempo sólo es tardanza*
>
> *De lo que está por venir;*
>
> Delay (*tardanza*), that is, tension: time is tension.

What is clear to the linguist and to the poet is also clear to the novelist. If you open Proust's masterpiece, you will notice that the first fourteen pages or so are entirely filled with the narrator lying on some bed in the darkness, unsure and confused about time and space, adrift, asking himself what room is this, of the many he has slept in during the course of his life. That is as it should be in a novel whose main character is space-time – the two are inseparable for Proust, just as they are inseparable for Einstein, although not for Bergson. The nature of Proust's main character, however, is completely different from Einstein's. The latter, as we saw above, posits a "conceptual ordering principle for recollected experiences, and the possibility of its accomplishment gives rise to the subjective concept of time." For Proust, to speak of "the subjective concept of time" would be like speaking of the "subjective concept" of one's digestion. By "conceptual ordering principle" Einstein means the order axioms that characterize the mathematical concept of the number line, which allow the physicists to identify time with a real coordinate: without such identification, physics as we know it would be inconceivable. Einstein, briefly put, is trying to persuade us that the physicist's sophisticated concept of time is in agreement with our subjective, psychological time. The whole of Proust's novel, and not just its first fourteen pages, endeavors to show that psychological time

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is *not* ordered like the number line, and that there are repetitions like the famous madeleine or like the narrator's experience at the Guermantes' court in *Le Temps retrouvé*, singular points when time curls on itself.

Finally, what is clear to linguist, poet, and novelist, is clear to the neuroscientist. Lisa Feldman Barrett reminds us that the main activity of the brain is neither conceptual nor ordering, but physiological. When you are very thirsty and come upon water, your thirst is slaked as soon as you drink, long before the water reaches your bloodstream; it is your brain that tells your body directly, not through your consciousness, that there is no need to feel the tension of thirst any longer:

"Your brain's most important job is to control your body – to manage allostasis – by predicting energy needs before they arise so you can efficiently make worthwhile movements and survive."[3]

Listening to or playing music, especially playing with others, is an excellent school for time as physiological and at once spiritual tension, and this is why Plato in his *Laws* places music, dance, and gymnastics at the very beginning and basis of human education. Einstein did play the violin in chamber ensembles, and one would think that the experience could have led him into insights about the nature of psychological time truer to life than the ones he proposed in 1954. But his personal investment into physics was incomparably more important than his involvement with music, and our emotional investments rarely fail to guide our philosophical commitments.

[3] Lisa Feldman Barrett, *Seven and a Half Lessons About the Brain*, Houghton Mifflin Harcourt, Boston & New York, 2020, p. 10.

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